

Death from a Caustic Detergent

FRANKLIN M. FOOTE, MD, DrPH

Dr. Foote is commissioner, Connecticut State Department of Health. Pathological examinations reported in this paper were performed at Day Kimball Hospital, Putnam, Conn. Tearsheet requests to Franklin M. Foote, MD, Commissioner, Connecticut State Department of Health, 79 Elm St., Hartford, Conn. 06115.

The Federal Water Quality Administration recently stated that removal of phosphates from detergents is essential to combat water pollution. Since then environmental authorities in several places across the country banned the use of phosphate detergents. Following the ban, several non-phosphate detergents labeled "non-polluting" have been marketed and widely promoted.

In Connecticut a young child died from the toxic effects of nonphosphate detergent powder, following a 6-day illness. The evidence suggests that the toxic effects were produced by inhalation. I believe this is the first report of a death from such inhalation.

On the afternoon of August 5, 1971, the mother of a 15-

month-old girl borrowed a box of laundry detergent powder from a neighbor. She poured a cupful, placed the cup on a table, and went next door to return the box. When the mother got back home, she found her child had the detergent powder on her lips and hands.

The mother then read the material printed on the box of laundry powder. "Nonpolluting, nonphosphate detergent" appeared in large letters on the box. In small type at the bottom of one of the panels was the warning: "Caution, contains sodium carbonate. Avoid contact with eyes . . . If swallowed give water or milk followed by diluted vinegar. Contact a physician. Keep out of the reach of children."

Emergency Treatment

The mother telephoned her personal physician and on his advice administered a cup of water containing 4 teaspoons of vinegar in accordance with the antidote instructions printed on the box of detergent powder. The child thereupon vomited five or six times and was taken to the physician's office 20-30 minutes later.

During the initial examination in the physician's office, the child sounded croupy and had difficulty breathing, but no fever was present. She was given 0.3 ml. of adrenalin and sent home. Approximately 3 hours later, however, the mother took the child back to the physician's office because the child had vomited bloody material and was again having difficulty breathing.

The child appeared acutely ill and croupy. The physician indicated there was a possibility of asthmatic bronchitis and administered syrup of ephedrine and benadryl. The child was then sent to the hospital.

Hospital Treatment

On admission to the hospital, the child's rectal temperature was 102° F., her pulse rate was 160 per minute, and her respiration 30. Her lungs were clear, but she had croupy breath sounds. Her white blood cell count was 27,900 per cubic millimeter; 82 percent of the cells were polymorphonuclear, 17 percent lymphocytes, and 1 percent monocytes.

Roentgenologic examination of the chest gave negative results.

The child had marked inspiratory and expiratory stridor. She was given an intramuscular injection of 250 mg. of ampicillin at the time of admission and every 6 hours afterward. Because it was thought that the child had tracheobronchitis, she was put in a cool mist.

The harsh breath sounds continued throughout the child's hospital stay. Two days after admission, her pulse rate was 160 and her rectal temperature ranged between 100.2° and 101.5° F. She seemed apprehensive and anxious, but her color was good. Her white blood cell count was 18,100 per cubic millimeter; 72 percent of the cells were polymorphonuclear, and she seemed to be responding to the antibiotic.

X-rays of the chest showed a zone of infiltration in the left lower lung. The epiglottis was edematous and red. There was generalized retraction in the supraclavicular, suprasternal, intercostal, and subcostal spaces. The child's lips and nail beds were pink.

In the evening of the second day, a tracheotomy was performed and a 4 inch by 3 inch by 2 mm. fragment of cartilage was removed from the trachea. No recognizable mucosa was present. The connective tissue of the submucosa had an increased basophilia, which suggested chemical or mechanical trauma. An endotracheal tube was inserted.

On the third day, the child's color was fair, and she was alert but restless. Breath sounds in the chest were harsh bilaterally and accompanied by coarse rhonchi. The white blood cell count was 17,200; 60 percent of the cells were polymorphonuclear.

Five days after the child's admission the endotracheal tube

was replaced. The child appeared cyanotic and was given oxygen. Late in the evening, she seemed to be doing well. During the early morning of the next day, however, her condition deteriorated and she died.

Autopsy Findings

The autopsy revealed no significant changes in most of the body organs. There was nothing remarkable in the esophagus or stomach. Gross examination revealed a focal congestion in the lungs but no evidence of pneumonia. Microscopic examination confirmed the absence of pneumonia.

There was extensive edema of the larynx, and a large plug of firm white material in the lower part of the larynx, possibly representing mucosa, extended approximately 2 cm. to somewhat below the level of the tracheostomy site. The tracheostomy site was clear and extended through the seventh and eighth tracheal cartilages.

Below the tracheostomy site the mucosa of the trachea was a greenish-red color with thickening ulceration and partial sloughing. This condition extended to the carina and approximately 1 cm. into the major bronchi to the level of the second division. Beyond this, the bronchial mucosa was markedly congested.

Microscopic sections of the trachea showed severe coagulative necrosis, with loss of the mucosa and necrosis extending to the submucosa. The area of the mucosa was partly covered by a plug of coagulated material resembling fibrin. Polymorphonuclear leukocytes and cellular debris were scattered in the plug and the area of necrotic mucosa.

No bacterial colonies or fungal elements were identified. Testing

for bacteria with a special stain did not reveal the presence of microorganisms. In some areas a thick layer of squamous epithelium covered an edematous and necrotic stroma, a covering which suggested that a reepithelization of the necrotic mucosal tissue had occurred. No changes consistent with viral reaction were seen in the submucosal glands or in the residual mucosa adjacent to the area of necrosis. Examination of the necrotic areas and of the luminal plug by polarized light was noncontributory to a diagnosis.

The final anatomic diagnosis was tracheal obstruction due to severe necrotizing tracheobronchitis consistent with a chemical origin.

The child was believed to have inhaled some of the nonphosphate detergent powder into her larynx, trachea, and upper bronchi. An analysis of the detergent showed that its pH was 10.1 to 10.3 and its contents by weight were 54 percent carbonates, 11 percent bicarbonates, plus some silicates.

Conclusion

Because treatment of such poisonings is not always satisfactory, emphasis must be put on preventing their occurrence. Packages of nonphosphate detergents and similar household chemicals should carry a warning—in larger letters than they now do—not only against swallowing or contact with the eyes, but also against inhaling the powder. Further, the warning should state that the package should be kept out of the reach of children.

In this particular case, the large letters "Nonpolluting" may have given the mother the impression that the product was nontoxic to human beings.